ERIC Document Resume	See Instruction Sheet	DATE OF RESUME 8/15/65	DATE RECEIVED

A. PUBLICATION DATA

1. ERIC NUMBER	2. ORIGINATOR CONTROL NO(S).	3. IDENTIFICATION NO.	DO NOT WRITE IN SPACE BELOW
ED000533	7284,		

4. AUTHOR(S): Stephens, W. Richard

5. TITLE OF DOCUMENT ABSTRACTED: A Brief Summary and Analysis of a Study in Critical Thinking Conducted at Greenville College

6. PUBLICATION TITLE: N.A.

7. EDITOR(S): N.A.

8. PLACE OF ORIGIN
ORG. Greenville College
ST.
CITY, STATE Greenville, Illinois
TELE. EXT.
INST/LOC CODE

9. PUBLISHER OR SOURCE: Greenville College

10. VOL.	11. PAGES	12. MO./YR.	13. TOTAL PP.
N.A.	N.A.	59	

MICROFILM COPY AVAILABLE YES ■ NO □

COPYRIGHT GRANTED YES □ NO ■

COPYRIGHT RELEASE FILED YES □ NO □

TYPE OF REPORT
PROPOSAL □
IN-PROGRESS □
FINAL ■
FOLLOW-UP □

OTHER ERIC REFERENCES:

ERIC SATELLITE CODE

B. INDEXING DATA

14. SUBJECT AREA

15. TYPE OF ENDEAVOR: Experimental Study

16. INDEXING TERMS (8-12)

	factulty			
experimental studies	attitudes			
teaching methods				

17. ABSTRACT (MAX. 250 WORDS)

An investigation of relative effects of certain methods of instruction on the improvement of critical thinking, conducted at Greenville College in 1958-59. Presents procedures, faculty opinions and attitudes, conclusions, and recommendations.

ERIC No.

18. SOURCE OF ABSTRACT

C. FUNDING DATA

19. SUPPORTING ORGANIZATION	20. DIVISION OR DEPT.	21. CONTRACT NO. / PROJECT NO.
	22. TOTAL COST OF PROJECT	
	23. DURATION OR PROJECT	U.S. Department of Health, Education, and Welfare Office of Education

ERIC Form 1

IV-21

A BRIEF SUMMARY AND ANALYSIS OF A STUDY IN CRITICAL THINKING CONDUCTED AT GREENVILLE COLLEGE, Greenville, Illinois 1950-1959

U. S. DEPARTMENT OF HEALTH, EDUCATION AND WELFARE
Office of Education

This document has been reproduced exactly as received from the person or organization originating it. Points of view or opinions stated do not necessarily represent official Office of Education position or policy.

This Report for

Dr. John X. Jarrich
North Central Workshop Director

by

W. Richard Stephens
Study Supervisior
Workshop Project

ED000533

13/60

INTRODUCTION

The Illinois Study on Improving Critical Thinking had its beginning approximately four years ago. Greenville College was one of the original member institutions of this study group, and is still an active participant. Other institutions actively engaged in this study are Wheaton College and Illinois Wesleyan. This research project is being carried on under the auspicies of the North Central Association Committee on Liberal Arts Education, with Dr. Willard G. Harrington, Director of the Office of Evaluation Services, Michigan State University, as the research consultant.

Previous to the 1958-59 school year several instructors at the member institutions designed and carried on pilot experiments in teaching to improve critical thinking. Though favorable results accured from these experiments, along with the feeling that this was a much needed area of study, to plan and carry out the experiment described herein.

This report will deal specifically with the experiment as conducted by some of the faculty of Greenville College, beginning in September 1958 and ending in May 1959.

STATEMENT OF THE PROBLEM

The purpose of this study was to investigate the relative effects of certain methods of instruction on the improvement of critical thinking in the 1958-59 freshmen students attending Greenville College.

Specifically this was an attempt to improve the thinking abilities of this particular group of students through the use of hypothesized methods of instruction, being uniformly employed by all instructors of this class, for the entire school year of 1958-59. See Exhibit A

DEFINITION OF TERMS

Critical Thinking: Those mental abilities as measured by A Test for Critical Thinking, Form - G, copyright 1952, by the American Council on Education. The specific abilities measured by this test, and used in this report to further define the term, are as follows:

Definition of the problem to be solved
Formulating and reasoning from hypotheses
Gathering and evaluating data
Drawing valid conclusions

Hypothesized Methodology: Those methods of instruction which are found in exhibit A of this report, viz.

Control Group: The freshmen class of 1957-58 at Greenville College. This class was tested during its first year at the same times and with the same tests as the experimental group.

Experimental Group: The freshmen class of 1958-59 at Greenville College.

PROCEDURES

The testing program at Greenville College has been uniform in that all entering students are required to complete certain tests. Since the freshmen class of 1957-58 was tested with the standard battery, which included A Test for Critical Thinking, Form - F, at the beginning of the year in September, it was decided to re-test this group with A Test for Critical Thinking, Form - G, at the close of the year - April or May 1958. With this accomplished, it was decided that this, being a representative group of freshmen at Greenville, serve as the control for the experiment to take place in 1958-59. The incoming class of freshmen in 1958-59 completed the same testing program which was required of the previous year's freshmen class. The 1958-59 class was then designated to be the experimental group for the study to follow that year.

The methods of instruction to be used on the experimental group were faculty originated from pilot studies conducted previously, from surveys of the results of other studies in teaching for critical thinking at other institutions, and from their own experiences in teaching. The primary feature of these methods was that they were distinctly different from the previous year's methods, and theoretically valid. This cooperative planning by the faculty of the experimental class contributed to a high degree of "commoness" in the methodological experiences of the freshmen. In order that this "commoness and differentness" of method might be assured throughout the experiment, a report was devised which was to be completed by each participating faculty member and submitted to the study supervisor at the end of every third

Procedures cont'd

week. See exhibit B. The supervisor in turn analyzed these reports for general commonness and differentness as well as for problem areas. Following the submission of reports, a meeting of the experimental faculty was held to discuss the reports and problems encountered in the carrying on of the study. Occasionally new information was given to the group by the study supervisor at these meetings. Also the importance of establishing the fact that something different, in line with exhibit A, was taking place in the classroom was repeatedly emphasized, since any meaningful outcome of the study rested upon this assumption. These triweekly reports were then filed for each instructor and from them a list of methods consistently common, as well as different from the previous year's, to most of them was compiled at the close of the experiment. See exhibit C.

At the close of the experiment in May 1959, the final testing of the experimental group with A Test for Critical Thinking, Form - G, was completed. A ststistical and interpretive analysis of the results follows. Soon after the experiment had ended, a questionnaire, see exhibit D, was circulated to the experimental faculty. This questionnaire was designed to get at attitudes, opinions, and other subjective data relevent to the experiment. An analysis of the questionnaire follows.

TABLE I

A Summary of Test Data on

the Experimental and Control Groups

Group	N	Form-G Pre-Test Scores -Means-	Form-G Means Pre to Post -Means-	Freshmen Year Grade Point Ave. -Means-	Freshmen Year ACT Scores -Means- Percentiles
Control	99	20.40	4.45	2.47	55.6
Experimental	116	20.81	6.02	2.53	49.6

TABLE II

A Summary of Test of Significance of Difference

between Experimental and Control Groups on Gains in Critical Thinking

Group	N	Mean Pre-Test on Form-G	Mean Post-Test on Form- G	Mean Gain	t - P
Cont.	99	28.48	32.93	4.45	2.15-2.63
Exp.	106	29.04	35.06	6.62	

This table shows a mean gain of 1.57 points in critical thinking by the experimental group over the control section. This is a significant difference at less than the .05 level of confidence.

TABLE III

Number of Frequencies of
High and Low ACE and High and Low Gains in Critical Thinking
on Selected Upper and Lower Experimental and Control Groups

Experimental Group

	Gains Low	Gains High		
High ACE	9	23	32	
Low ACE	16	16	32	
	25	39	64	

Chi Square 3.21-P-L.10

Control Group

	Gains Low	Gains High	
High ACE	19	21	40
Low ACE	16	7	23
	35	28	63

Chi Square 2.88-P-L.10

Chi Square Combined Groups - 6.09 - P-L.05

To select these high and low experimental and control groups a regression line was plotted for gains in critical thinking and pre-test critical thinking scores. All cases two points above and below this line were selected to compose the high and low groups respectively.

These tables seem to show a relationship between high ACE scores and high gains in critical thinking.

Further observation tends to show a greater percentage of students making higher gains in critical thinking in both the high and low ACE groups of the experimental section as compared with the control section.

TABLE IV

The Distribution
of Grade Point Averages for High and Low ACE Groups
for the entire Experimental and Control Groups

	ACE	
Cont. GPA	1.89	2.86
Exp. GPA	2.09	2.92

The 50 percentile was the separating score between the high and low ACE groups shown above.

This table shows that the low ACE group in the experimental section was not penalized in grade point average more so than the comparable group in the control section. In fact the higher grade point average of the low ACE experimental group, compared to the same group in the control section, appears to be of a significant difference.

FACULTY OPINIONS AND ATTITUDES

After the close of the experiment in May 1959, a questionnaire was circulated to the instructors of the experimental group. (See Exhibit D.) This questionnaire was designed to get at attitudes, opinions, and other subjective data which might prove relevant to the study. The following is a summary of the analysis of these questionnaires.

A large majority of the experimental faculty felt:

1. That the objective of critical thinking was achieved to a more significant degree with the use of the new methods.
2. That the poorer students were not hindered in subject-matter achievement.
3. That the poorer students were able to improve their critical thinking abilities as a result of the different methods.
4. That in no way were the different methods more harmful to their students than the methods used in former years.
5. That there was a significant relationship between the methods of teaching they used and the improvement of critical thinking.
6. That possibly there was some relationship between the personality of the teacher and the improvement of critical thinking.
7. As strongly or more strongly about the importance of teaching for the objective of critical thinking.
8. Firmly convinced that the objective of critical thinking is one that we at Greenville College can and must teach for, but that it should not be featured more than the other objectives.
9. That the most of their students made observable improvement in their ability to think critically as the year progressed.
10. That their assignments, tests, and instructional materials influenced favorably the improvement of critical thinking.
11. That the study was successful in improving the student's ability to think critically. They also felt that it was intellectually stimulating, challenging, and provocative, as well as an impetus to try new approaches and keep "out of a rut."
12. That perhaps there was, at the beginning, too much labeling of the objective of critical thinking.
13. One or two felt that their courses did not lend themselves readily to teaching for the critical thinking objective.

CONCLUSIONS

1. There is a significant difference between the mean gains in critical thinking of the experimental group over the control group. See Table II.

2. There appears to be a significant relationship between high ACE scores and high gains in critical thinking. A greater percentage of low ACE students in the experimental section made high gains in critical thinking than did the comparable group in the control section. Se Table III.

3. The low ACE students in the experimental section were not penalized in grade point average, as a measure of achievement, more so than the low ACE students in the control section. See Table IV.

4. It is evident that the objective of critical thinking can be specifically taught for by the faculty of Greenville College and a significant improvement made by the student.

5. There appears to be a significant relationship between the use of the hypothesized methods of instruction (see Exhibit A), and the improvement of critical thinking; and a concomitant improvement in general classroom achievement. Note Tables I and IV.

6. It is apparent that instructors at Greenville College can adapt their methods of instruction to achieve the objective of critical thinking.

7. It is evident that Greenville College students can make appreciable improvement in their critical thinking abilities.

8. It is apparent that a large majority of the freshmen courses at Greenville College can be handled so as to involve the student in the processes of critical thinking.

9. It appears evident that students respond, by greater improvement in critical thinking, to a rather uniform instructional approach by the faculty.

RECOMMENDATIONS

1. That instructors at Greenville College continue to experiment with these and related methods of instruction in their classes.

2. That subsequent instructors of the experimental students make maximum provisions for the continued development of their critical thinking abilities, concomitant to other course objectives. Perhaps this could best be achieved by employing some of those methods, and others related, in exhibit A of this report.

3. That the control and experimental groups of this study be tested in their respective senior years with A Test for Critical Thinking, Form - G, and follow with an analysis of the results.

4. That study in some of the following areas, as they relate to teaching for critical thinking, be started. Student Personality Types - Teacher Personality Types - Educational Press of the Institution - Motivations of Students - Study Habits

5. That where possible and feasible instructors give consideration to the use of methods of instruction, exhibit A, and related methods.

EXHIBIT A

A GUIDE
FOR EXPERIMENTAL METHODS OF INSTRUCTION

I. Activities related to assignments

A. Assignment should be made in the form of problems or questions rather than page assignments. In so far as possible this should be done everyday, not just when the spirit strikes.

B. The problems presented to students should in so far as possible and as the material of the course allows, be specifically and clearly related to student needs and student interests. The instructor should constantly search for ways of stating problems that are within the experience range of students.

C. Assignments should encourage student positing of problems. Thus in so far as possible, students in the class should be asked to help set the assignments in terms of their own interest and their own needs.

D. The course should be arranged so as to give students time to do critical thinking. There was the feeling that many of our assignments are so large that students just do not have the time to do much more than read and to memorize.

E. Assignments should constantly emphasize the connection between that course and other courses. It has become almost axiomatic that transfer of training to happen at all must be facilitated by the teacher. The assignments a teacher makes can help in this regard.

II. Tests as a Means of Developing Problem Solving Ability-See exhibit E.

A. Tests should generally be of the problem type rather than those commanding only recall of information. Tests may be either of the objective or the essay type, but ought to focus on problems which draw on materials from the course, but which require these materials to be viewed in the light of a new situation.

B. Questions which require summary and bringing together of a variety of facts and principles ought to be used.

C. A variety of test forms should be attempted so that students do not develop stereotyped ways of approaching their solutions.

D. Open book examinations in which independent thinking is actively encouraged is another appropriate technique.

E. Tests and examinations ought to be short enough to allow students to think. The feeling here was that typically

examinations required so much recall that students had little time to do more than write out memorized facts.

F. Class time ought to be devoted to the review of every test.

III. Suggested Instructional Materials

A. Considerable use should be made of outside materials, films, guest speakers, tape recordings and the like. Then the content of each of these ought to be treated analytically rather than just descriptively.

B. The use of tape recordings of classroom performances and a replaying of these tapes to portions of a class seem to have some merit.

C. The use of a bulletin board or a flannel board or blackboard should be attempted very frequently.

D. Student participation in obtaining materials to be used in class is another approach.

E. The use of the Science Research Associates Punch Board for test situations might be attempted.

IV. Teacher Conduct in Class

A. The experimental classes should be encouraged to participate very actively.

B. The physical set-up of the experimental classes might be varied. Breaking the orthodox pattern of seats in rows.

C. The experimental classes ought to be characterized by a somewhat more permissive atmosphere than the control.

D. Larger units ought to be the focus of attention rather than the small ones so as to encourage students to see interrelationships between a number of facts of the study.

E. More individual and committee work ought to be encouraged rather than treating the entire class as a unit.

F. The teacher ought to give specific attention to the level of difficulty of materials and the aptitude level of the students of the class.

G. Some of the newer techniques such as the psychodrama and role playing ought to be attempted frequently.

H. Individual student conferences ought to be encouraged and with maximum ease for the students.

I. The teacher should lay greater stress on independent work.

II. Tests

	Extent of use		
	Once	Several Times	Nearly Every Day
A. Problem Solving			
B. Require Summarization			
C. Variety			
D. Open Book Tests			
E. Short enough for problem solving thought			
F. Post test review			
G. Others			

III. Instructional Materials

	Extent of use		
	Once	Several Times	Nearly Every Day
A. Films, Guest Speakers, etc.			
B. Classroom recordings			
C. Bulletin Boards			
D. Self-scoring Tests			
E. Student Resources			

IV. Teacher conduct in class

	Extent of use		
	Once	Several Times	Nearly Every Day
A. Free Student Participation			
B. Variations in Seating			
C. Permissive Atmosphere			
D. Keeping Broad Perspectives Though More Comprehensive Units of Work			
E. Individual and Committee Work			
F. Aptitude Level			
G. Role Playing, etc.			
H. Individual Student Conf.			
I. Stress Independent Work			

V. In contrast with last year, which of the above devices were the most successful during the past three weeks?

Comment:

EXHIBIT C

The following is a list of the methods of instruction used by the faculty of the experimental group. These methods were common to most of the faculty as well as different from previously used methods.

This list was compiled from the tri-weekly reports submitted to the study supervisor.

1. Committee work in class
2. Allowed more time for thinking in class
3. Facilitated the interrelationships among courses
4. Provided for more independent work in and out of class
5. Created a more permissive classroom atmosphere
6. Encouraged free student participation in the classroom
7. Designed tests from a problem solving approach
8. Used open book tests
9. Made a greater use of films, guest speakers, etc.
10. Assignments were made in the form of questions or problems

EXHIBIT D

CRITICAL THINKING QUESTIONNAIRE

This questionnaire is an attempt to get at your attitudes and opinions concerning your participation in the "critical thinking study" last year, 1958-59. Would you please respond to the statements to the best of your knowledge. Be as brief or elaborate as you wish in responding to the open end items. The information reported here will be a valuable aid in interpreting the statistical analysis of the study.

1. Do you feel that the objective of critical thinking was achieved to a more significant degree with the use of methods differing from those in former years? YES NO

2. Do you feel that the poorer students were hindered in subject-matter achievement in your class or classes? YES NO

3. Do you feel that the poorer students were able to improve their critical thinking abilities as a result of the different methods you used? YES NO

4. Would you say that the different methods were in any way more harmful to your students than the previous methods used in your teaching? YES NO

5. Do you feel that there is a significant relationship between the methods of teaching one employs and the improvement of critical thinking? YES NO

6. Do you feel that there is a significant relationship between the personality of the teacher and the improvement of critical thinking? YES NO

7. Do you feel that the personality of the teacher or the methods of the teacher has the greatest relationship to the improvement of critical thinking? A. Personality of teacher B. Methods of teacher

8. Do you feel more strongly about the importance of critical thinking now than you did at the beginning of the study? YES NO

9. Do you plan to adopt for next year's classes any of the new or different methods you used during the past year? YES NO

10. If you answered number ten yes, would you please state the method or methods?

11. Are you firmly convinced that the critical thinking objective is one that we at Greenville College must teach for? YES NO

12. Did you feel that the most of your students were quite inept at thinking critically at the beginning of the experiment last fall?
YES NO

13. Do you feel that the most of your students made observable improvement in their ability to think critically as the year progressed?
YES NO

14. If your answer to number 13 was yes, would you please state the reasons why you think the improvement was made?

15. If your answer to number 13 was no, would you please state the reasons why you think they failed to show any improvement?

16. Do you feel that there were instructional materials which had a significant influence upon the improvement of critical thinking?
YES NO If so, list them.

17. Do you feel that any of the tests you gave, or the way in which you administered the tests, influenced favorably the improvement of critical thinking? YES NO If so, would you please describe the test and/or method of administration.

18. Do you feel that any of the assignments you gave influenced favorably the improvement of critical thinking? YES NO If so, briefly describe the types of assignment.

19. Would you please list below a description of the completely different methods of teaching for you which you used in the experiment this year?

20. Please mark how you would rate the success of the study in improving critical thinking. Very successful Successful Unsuccessful

21. Would you list any favorable or unfavorable observations about or comments from your students concerning the experiment this year?

22. If you care to do so, would you kindly give your feeling about the study this year?

EXHIBIT A

GUIDE FOR CONSTRUCTION OF EVALUATION ITEMS[1]

1. Problems -- ask a question which requires the student:

   a) to identify the problem to which the statement gives the answer and to recognize the central problem to which a number of statements are addressed.

   b) to indicate, with reasons, whether or not a given problem is stated specifically enough to permit an investigation to be undertaken to obtain an answer.

   c) to indicate whether certain non-scientific factors, matters of judgments or matters of faith, are contained in the problem thereby making a purely scientific solution impossible.

2. Information -- (data, laws, and principles) -- ask a question that requires the student:

   a) to recognize when the information he possesses is irrelevant to a given problem.

   b) to indicate what sort of information appropriate for a given problem.

   c) to evaluate the adequacy of given sources of information in relation to a given problem.

   d) to indicate his ability to apply information he possesses as is pertinent to the solution of a given problem.

3. Hypotheses -- ask a question which requires the student:

   a) to formulate or recognize hypotheses based on given data or situations.

   b) to identify the evidence necessary to judge the truth of a given deduction from an hypothesis.

   c) to formulate an experiment which will test the truth of a given hypothesis.

   d) to recognize when observations or experimental data support or do not support a given hypothesis, and to what degree.

   e) to recognize assumptions involved in the formulation of an hypothesis.

4. Conclusions -- ask a question which requires the student:

   a) to recognize the generalization(s) involved in an interpretation or conclusion.

---

[1] Paul J. Trimmer and Lewis D. Mayhew, Selective Reporting and Understanding (Dubuque, Iowa: Wm. C. Brown Co., 1962).

b) to detect the unstated assumptions involved in a conclusion.

c) to recognize when evidence used in context is adequate for drawing a conclusion.

d) to recognize in a line of reasoning whether an observation plays the role of a premise or verifies the conclusion.

e) to recognize in a paragraph or statement proper or improper use of such reasoning as deduction, induction, citing authority, or analogy.

f) to differentiate fact and assumption in a paragraph or statement.

g) to recognize the difference between statements or inferences based on scientific evidence and those which contain opinion.

3. Attitudes -- ask a question which requires the student:

a) to recognize in a paragraph or statement proper or improper use of such concepts as causality, teleology, simplicity, consistency, tentative nature of truth, and operationalism.

b) to assess a situation and recognize appropriate action in harmony with the nature of science and society.

EXHIBIT F

CRITICAL THINKING

Observation Record

This rating technique should help the teacher to systematically collect evidence on the behavior of students in a class. It might be interchangeably used to evaluate the progress of individuals and the group.

1. Is the student becoming more sensitive to the existence of problems in this area of study?

2. Is the student formulating problems more clearly?

3. Is the student formulating problems in forms which can be researched?

4. Is the student becoming more skillful in stating hypotheses and alternate possibilities for attacking the problem?

5. Is the student becoming more skillful in locating relevant information?

6. Is the student becoming more careful in his observation?

7. Is the student learning to use written sources?

8. Is the student learning to play a variety of roles in co-operation with others as they attack the problem?

9. Is the student developing skill in organizing data and in screening the relevant from irrelevant materials?

10. Is the student interpreting data more sensitively and accurately?

11. Is the student learning to draw conclusions more skillfully?

12. Is the student developing the ability to communicate the results of his critical thinking to others in written or verbal form?

13. Is the student aware of the ways in which his biases and emotions affect his critical thinking?

14. Is the student becoming more able to overcome emotional limitations on his critical thinking?

It is conceivable that the phrase "Is the student" be substituted with "Am I" and thereby make this scale into a self-rating scale for the student. It further may be substituted with "Are the students" and thereby serve as a group rating scale to be used by the teacher. Comparisons may be made between the ratings by the teacher and the students and thus more clearly point out weaknesses. (Suggested for use at Greenville by W. P. Stephens.

Source of scale: Critical Thinking In Current Affairs Discussion,
396 Washington St., Middletown, Conn.